FMS

- Workparts are loaded and unloaded at a centr location in the FMS.
- Pallets are used to transfer workparts betⁿ m/cs
- Once a part is loaded onto the handling system, it is automatically routed to a particular workst required in its processing.
- For each different workpart type, the routing may b different and the operations & tooling required at each workstation also differs.
- The coordination & control of the parts handling & procesing activities is accomplished under command the computer.
- One or more computers can be used to control a sing FMS.
- The computer system is used to control the m/c tools material handling system to monitor the performance the system & to schedule production.
- Human labor is required to operate the CIMS. Among the functions performed are loading & unloadin of workparts; changing tools, tool setting & programmin the computer system.

Components of CIM

1) M/c tools & related equipment
2) Materials handling system
3) Computer system
4) Human labor.

M/c tools & Related equipment

It includes:- 1) Standard CNC m/c tools
2) Special-purpose m/c tools
3) Tooling for these machines
4) Inspection stations or special inspection probes used with the m/c tools

The selection of the particular m/cs that make up a CIMS depend on the processing requirements to be accomplished by the system.

Some of the factors that define the processing requirements are as follows:-

(1) Part size:- The size of the workparts to be processed on the CIMS influences the size & construction of the machines. Larger parts require larger m/cs.

2) Part shape:- Machined workparts usually divide themselves naturally into two types according to shape; round & prismatic.

- Round parts (gears, shafts, disks) → require turning & boring operations.
- Prismatic parts (cube shaped & nonrotational) → require milling & drilling operations.

3) Part variety:- If the part variety is limited, the m/c tools would be more specialized for higher production.
- If a wide variety of parts are to be processed, standard m/c tools (more versatile) should be selected.

(4) Product life cycle :-
If the product life cycle is relatively long, the CIMS can include more specialized & less flexible m/c tools.

(5) Definition of future parts :-
- Another factor that affects the versatility of CIMS is the level of knowledge about parts which are to be procesed.
- 1st case; where the manufacturing system is design to proces a family of parts that are completly known in advance.
- Othe case:- where the future parts are not known in advance. New part designs must be accommodated by the system. Thus, its m/c tools must possess a significant degree of flexibility.

(6) Operations other than machining;-
Most computer-integrated manufacturing (CIM) system are designed for machining exclusively. In some cases the processing requirements include other operations such as assembly or inspection.

Material handling System
- The material handling system in a CIMS must be designed to serve two functions. Primary M
The 1st function is to move workparts betn m/cs
The 2nd function is to orient and locate the workpart for processing at the machines → Secondary handling syst
- These two functions are often accomplished by mea of two different, but connected material handling systems.

- The requirements usually placed on the primary material handling system are :-

* It must be compatible with computer control
* It must provide random, independent movement of palletized workparts bet^n m/c tools in the system
* It must permit temporary storage of parts.
* It should allow access to the m/c tools for maintenance, tool changing & so on.
* It must interface with the secondary work handling system

The secondary work handling systems generally consisting one transport mechanism for each m/c
The specifications placed on the secondary materials handling system are :-

(1) It must interface with the primary handling system. Parts must be compatible with computer transferred automatically bet^n the primary system & the secondary system.

(2) It must be compatible with computer control

(3) It must permit temporary storage of parts.

(4) It must provide for parts orientation & location at each workstation for processing.

(5) It should allow access to the m/c tool for maintenance, tool changing & so on.

Computer Control System

A digital computer system is used to manage the operation of a complex manufacturing system. The functions accomplished by the computer control system is divided into 8 categories.

(1) Machine Control :-

This is usually done by CNC. The advantage of CNC is that it can be conveniently interfaced with the other elements of the computer control system.

(2) DNC :-

Most computer-integrated manufacturing systems operate under DNC. The purpose of DNC is to perform the usual DNC functions, including NC part program storage, distribution of programs to the individual machines in the system, post processing so on.

(3) Production Control :-

- The computer performs the production control functions by routing a pallet to the load/unload area and providing instructions to the operator to load the desired raw part.
- A data entry unit (DEU) is located in the load/unload area for communication b/n the operators and the computer.

(4) Traffic Control :-

- This term refers to the regulation of the primary workpiece transport system which moves parts b/t workstations.
- This control can be accomplished by dividing the transport system into zones.

- A zone is a section of the primary transport system which is individually controlled by the computer.
- By allowing only one cart or pallet to be in a zone, the movement of each individual workpart is controlled.
- The traffic controller operates the switches, stops workparts at m/c tool loading points & moves parts to operator load/unload stations.

(5) Shuttle control:-

- This is concerned with the regulation of the secondary part handling systems at each m/c tool.
- Each shuttle system must be coordinated with the primary handling system & it must also be synchronized with the operations of the m/c tool it serves.

(6) Work handling system monitoring:-

The computer must monitor the status of each cart/pallet in the primary and secondary handling systems, as well as, the status of each of the various workpart types in the system.

(7) Tool control:-

- Monitoring & control of cutting tool status is an important feature of computer system.
- There are two aspects to tool control:

a) Accounting for the location of each tool in CIMS
b) Tool life monitoring.

- The 1st aspect of tool control involves keeping track of the tools at each work station.
- If 1 or more tools required in the processing of a particular workpart are not present at the workstation specified in the part's routing, the computer control system will not deliver the part to that station. It will determine an alternative machine to which the part can be routed; or it will temporarily float the part in the handling system.
- In the 2nd case, the operator is notified via the data entry unit what tools are required in which workstation. The operator then manually loads the tools and notifies the computer accordingly.
- Any type of tool transaction (e.g. removal, replacement, addition) must be entered into the computer to maintain effective tool control.

The 2nd aspect of tool control is tool-life monitoring. A tool life is specified to the computer for each cutting tool in the CIMS.

- Then a file is kept on the machining time usage of each tool.
  When the cummulative machining time reaches the life for a given tool, the operator is notified that a replacement is required.

(8) System Performance Monitoring & Reporting

The computer can be programmed to generate various reports desired by management on system performance.

CIMS data files

(1) **Part program file:-**

The part program for each workpart processed on the system is maintained in this file.

For any given workpart, a separate program is required for each station that performs operations on the part.

(2) **Routing file:-**

The file contains the list of workstations through which each workpart must be processed. It also contains alternate routings for the parts.

(3) **Part production file:-**

- A file of production parameters is maintained for each workpart.
- It contains data relative to production rates for the various machines in the routing, allowances for in-process inventory, inspections required & so on.

(4) **Pallet reference file:-**

- A given pallet may be fixtured only for certain parts. The pallet reference file is used to maintain a record of the parts that each pallet can accept.
- Each pallet in the CIMS is uniquely identified and referenced in this file.

(5) **Station tool file:-**

A file is kept for each workstation, identifying the codes of the cutting tools stored at that station. This file is used for tool control purposes.

(6) **Tool life file:-** This data file keeps the tool-life value for each cutting tool in the system. The cummulative m/cing time of each tool is compared with its life value so that a replacement can be made before complete failure occurs.

System reports

The data collected during monitoring can be summarized for preparation of performance reports.

(1) Utilization reports:-
These are reports that summarize the utilization of individual workstations as well as overall average utilization for the system.

(2) Production reports:-
It lists the quantity of parts produced from the CIMS.

(3) Status reports:-
It shows the present condition of the CIMS.
It includes status data on work parts, m/c utilization, pallets & other system operating parameters.

(4) Tool reports:-
These reports relate to various aspects of tool control. Reported data might include a list of missing tools at each workstation.

Human Labor in the manufacturing system

The CIM is a highly automated production facility. However, human resources are required to operate the system.

1) System manager:- Overall responsibility for the operations of the CIMS.

2) Electrical technician:- Maintenance & repair services on the electrical components of the m/c tools & material handling system.

3) Mechanical / hydraulic technician:-

4) Tool setter :- making the tools ready for production.

5) Fixture set up & lead man:- This person is responsible for setting up the fixtures, pallets & tools for the system.

6) Load / Unload man's -
loading raw workparts & unloading finished parts.

7) Rover operator :-
The duties of the rover operator include reacting to unscheduled m/c stops, identifying broken tools or tools in need of immediate replacement, tool adjustments, etc.